WHAT IS CLAIMED IS:

1. A semiconductor laser comprising:

a gain region having wavelength selectivity;

a propagating region optically coupled to said gain region, having an effective refractive index whose temperature dependence differs from that of said gain region, and having no wavelength selectivity; and

a reflection region for reflecting light propagated through said propagating region.

2. A semiconductor laser comprising:

a gain region having wavelength selectivity;

a propagating region optically coupled to said gain region, having a material with an effective refractive index whose temperature dependence differs from that of said gain region, and having no gain nor wavelength selectivity; and

a reflection region that reflects light propagated through said propagating region, and has no gain.

3. A semiconductor laser comprising:

a gain region having wavelength selectivity;

a propagating region optically coupled to said gain region, having a structure with an effective refractive index whose temperature dependence differs from that of said gain region, and having no gain nor wavelength selectivity; and

a reflection region that reflects light propagated through said propagating region, and has no gain.

4. The semiconductor laser as claimed in any one of claims 1-3,

wherein said reflection region has a mirror or a diffraction grating with a periodic structure.

5. A semiconductor laser comprising:

a first gain region having wavelength selectivity;

a propagating region optically coupled to said first gain region, having a material with an effective refractive index whose temperature dependence differs from that of said gain region, and having no gain nor wavelength selectivity; and

a second gain region optically coupled to said propagating region, and having wavelength selectivity.

6. A semiconductor laser comprising:

a first gain region having wavelength selectivity;

a propagating region optically coupled to said first gain region, having a structure with an effective refractive index whose temperature dependence differs from that of said gain region, and having no gain nor wavelength selectivity; and

a second gain region optically coupled to said propagating region, and having wavelength selectivity.

7. The semiconductor laser as claimed in any one of claims 3, 4 and 6, wherein said structure is different in at least one of a layer structure, layer thickness and waveguide width.

8. The semiconductor laser as claimed in any one of claims 1-7, wherein an absolute value of a product of a length of said propagating region and a difference between a temperature differential coefficient of the effective refractive index of said gain region and a temperature differential coefficient of

the effective refractive index of said propagating region is equal to or greater than 7.5×10^{-4} [μm/K].

9. The semiconductor laser as claimed in any one of claims 1-8, wherein said propagating region is composed of a material whose temperature differential coefficient of the effective refractive index is different from that of a semiconductor.

10. The semiconductor laser as claimed in any one of claims 1-9, wherein said propagating region is composed of a material whose temperature differential coefficient of the effective refractive index is negative.

11. The semiconductor laser as claimed in any one of claims 1-10, wherein said gain region comprises a diffraction grating formed by periodic perturbation with at least one of real and imaginary parts of a complex refractive index.

12. The semiconductor laser as claimed in claim 11, wherein the length of said propagating region is determined such that a longitudinal mode spacing determined by a sum of an effective length of the diffraction grating of said gain region and a length of said propagating region, is greater than a stop bandwidth of said diffraction grating.

13. The semiconductor laser as claimed in claim 11 or 12, wherein the coupling coefficient of the diffraction grating of said gain region is greater than 300 cm^{-1}.

14. The semiconductor laser as claimed in any one of claims 1-13,

wherein said gain region, said propagating region and said reflection region are stacked.

15. The semiconductor laser as claimed in any one of claims 1-13, wherein said gain region and said propagating region are coupled via optical path changing means.

16. The semiconductor laser as claimed in any one of claims 1-15, wherein said propagating region has a waveguide structure having an optical confinement structure on at least one of upper and lower portions and left and right portions.

17. A semiconductor laser comprising:

a semiconductor substrate;

an active layer formed on said semiconductor substrate, and having a distributed reflection structure;

a cladding layer formed on said active layer;

a removed region from which part of said active layer and said cladding layer is removed; and

a temperature compensation layer buried in said removed region, and having an effective refractive index whose temperature dependence differs from that of said active layer.

18. A semiconductor laser comprising:

a semiconductor substrate;

a distributed Bragg reflection layer stacked on said semiconductor substrate;

an active layer stacked on said distributed Bragg reflection layer, and having a distributed reflection structure;

a temperature compensation layer stacked on said active

layer, and having an effective refractive index whose temperature dependence differs from that of said active layer; and

a reflection layer stacked on said temperature compensation layer.

19. A semiconductor laser comprising:

a semiconductor substrate;

an active layer formed on said semiconductor substrate, and having a distributed reflection structure;

a cladding layer formed on said active layer, and having an inclined surface at an end of said active layer; and

a temperature compensation layer formed on said cladding layer, and having an effective refractive index whose temperature dependence differs from that of said active layer.

20. An integrated optical waveguide comprising:

a first optical waveguide;

a second optical waveguide optically coupled to said first optical waveguide, and having a refractive index different from that of said first optical waveguide; and

a groove disposed so as to traverse an optical path of said first optical waveguide, and separated from an interface between said first optical waveguide and said second optical waveguide by a predetermined spacing, wherein

the spacing from said interface and the width of said groove are determined such that reflection at a boundary between said first optical waveguide and said second optical waveguide is weakened.

21. An integrated optical waveguide comprising:

a first optical waveguide formed on a semiconductor substrate;

a second optical waveguide formed on said semiconductor substrate, and having a refractive index different from that of said first optical waveguide; and

a semiconductor board disposed at a boundary between said first optical waveguide and said second optical waveguide, and formed on said semiconductor substrate perpendicularly to the waveguide direction and separately from said first optical waveguide via a groove, wherein

a width of said groove and a thickness of said semiconductor board are determined such that light reflected off an interface between said first optical waveguide and said groove is weakened by light reflected from an interface between said groove and said semiconductor board, and by light reflected from an interface between said semiconductor board and said second optical waveguide.

22. The integrated optical waveguide as claimed in claim 21, wherein said groove is filled with a material whose refractive index differs from the refractive index of said first optical waveguide, said first optical waveguide and said semiconductor board have a same refractive index, and said second optical waveguide and said material filling said groove have a same refractive index, and wherein either of the following expressions holds,

$N_1d_1 > \lambda/2n$, $N_2d_2 > \lambda/2m$, $N_1d_1 + N_2d_2 < \lambda/4(2l + 1)$

(l, m and n are integers satisfying a relation of n + m = l)

or

$$N_1d_1 < \lambda/2n,\ N_2d_2 < \lambda/2m,\ N_1d_1 + N_2d_2 > \lambda/4(2l + 1)$$

(l, m and n are integers satisfying a relation of $n + m = l-1$)

where N_1 and d_1 are a refractive index and width of said groove respectively, N_2 and d_2 are a refractive index and thickness of said semiconductor board respectively, and λ is a wavelength of the waveguide light.

23. The integrated optical waveguide as claimed in claim 21, wherein said groove is filled with a material whose refractive index differs from the refractive index of said first optical waveguide, and wherein the following expressions hold,

$$N_1d_1 + N_2d_2 = \pm\lambda/(2\pi)[\cos^{-1}\{\pm(N_1^2 + N_2^2)/(N_1 + N_2)^2\} + 2m\pi]$$

$$N_1d_1 - N_2d_2 = \lambda/2n$$

(m and n are integers)

where N_1 and d_1 are a refractive index and width of said groove respectively, N_2 and d_2 are a refractive index and thickness of said semiconductor board respectively, and λ is a wavelength of the waveguide light.

24. An integrated optical waveguide comprising:

a first optical waveguide formed on a semiconductor substrate;

a second optical waveguide formed on said semiconductor substrate, and having a refractive index different from that

of said first optical waveguide;

a first semiconductor board disposed at a boundary between said first optical waveguide and said second optical waveguide, and formed on said semiconductor substrate perpendicularly to the waveguide direction and separately from said first optical waveguide via a first groove; and

a second semiconductor board formed on said semiconductor substrate perpendicularly to the waveguide direction and separately from said first semiconductor board via a second groove, wherein

widths of said first groove and said second groove and thicknesses of said first semiconductor board and said second semiconductor board are determined such that light reflected off an interface between said first optical waveguide and said first groove is weakened by light reflected from an interface between said first groove and said first semiconductor board, by light reflected from an interface between said first semiconductor board and said second groove, by light reflected from an interface between said second groove and said second semiconductor board and by light reflected from an interface between said second semiconductor board and said second optical waveguide.

25. The integrated optical waveguide as claimed in claim 24, where said first semiconductor board and said second semiconductor board have thicknesses different from each other, or said first groove and said second groove have widths different from each other.

26. The integrated optical waveguide as claimed in claim 24 or

25, wherein said first groove and said second groove are filled with a material whose refractive index differs from the refractive index of said first optical waveguide; said first optical waveguide, said first semiconductor board and said second semiconductor board have a same refractive index; and said second optical waveguide, said first groove and said second groove have a same refractive index, and wherein either of the following expressions holds,

$$N_1d_1 > \lambda/2n,\ N_2d_2 > \lambda/2m,\ N_1d_1 + N_2d_2 < \lambda/4(2l + 1)$$

(l, m and n are integers satisfying a relation of n + m = l)

or

$$N_1d_1 < \lambda/2n,\ N_2d_2 < \lambda/2m,\ N_1d_1 + N_2d_2 > \lambda/4(2l + 1)$$

(l, m and n are integers satisfying a relation of n + m = l-1)

where N_1 and d_1 are a refractive index and width of said first groove respectively, N_2 and d_2 are a refractive index and thickness of said first semiconductor board respectively, and λ is a wavelength of the waveguide light.

27. The integrated optical waveguide as claimed in any one of claims 24-26, wherein said first groove and said second groove are filled with a material whose refractive index differs from the refractive index of said first optical waveguide; said first optical waveguide, said first semiconductor board and said second semiconductor board have a same refractive index; and said second optical waveguide, said first groove and said second groove have a same refractive index, and wherein the following expression

holds,

$$\lambda/2n - \lambda/16 < N_2 d_4 < \lambda/2n + \lambda/16$$
(n is an integer)

where N_2 and d_4 are a refractive index and thickness of said second semiconductor board respectively, and λ is a wavelength of the waveguide light.

28. The integrated optical waveguide as claimed in any one of claims 24-27, wherein said first groove and said second groove are filled with a material whose refractive index differs from the refractive index of said first optical waveguide; said first optical waveguide, said first semiconductor board and said second semiconductor board have a same refractive index; and said second optical waveguide, said first groove and said second groove have a same refractive index, and wherein the following expression holds,

$$\lambda/2(n + 1/4) < N1D3 < \lambda/2(n + 1)$$
(n is an integer)

where N1 and d3 are a refractive index and width of said second groove respectively, and λ is the wavelength of the waveguide light.

29. The integrated optical waveguide as claimed in any one of claims 24-28, wherein said first groove and said second groove are filled with a material whose refractive index differs from

the refractive index of the first optical waveguide, and wherein one or more semiconductor boards are alternatively disposed via one or more grooves in the waveguide direction, each semiconductor board having a same thickness as said second semiconductor board and each groove having a same width as said second groove.

30. The integrated optical waveguide as claimed in any one of claims 21-29, wherein said second optical waveguide is composed of a material having a negative refractive index temperature differential coefficient.

31. An integrated optical waveguide comprising two integrated optical waveguides as defined in any one of claims 21-30, which are disposed face to face with each other, wherein said second optical waveguides have their end faces connected to each other.

32. An integrated optical waveguide comprising a plurality of integrated optical waveguides as defined in claim 31, which are connected in cascade repeatedly.

33. The optical device as claimed in any one of claims 21-32, wherein said first optical waveguide comprises:

a core layer formed on said semiconductor substrate;

an upper cladding layer stacked on said core layer, and having a conductivity type different from that of said semiconductor substrate;

a first electrode formed on said upper cladding layer; and

a second electrode formed on a back surface of said semiconductor substrate.

34. The optical device as claimed in any one of claims 24-33, wherein at least one of said first optical waveguide and said second optical waveguide has wavelength selectivity.

35. An optical device comprising an integrated optical waveguide as defined in any one of claims 24-34.

36. An integrated optical waveguide comprising:

a first optical waveguiding region;

a second optical waveguiding region whose interface surface with said first optical waveguiding region is inclined with respect to the waveguide direction of said first optical waveguiding region, and having a refractive index different from that of said first optical waveguiding region; and

a third optical waveguiding region whose interface surface with said second optical waveguiding region is disposed such that a refraction direction through the interface surface with said second optical waveguiding region is in line with the waveguide direction.

37. An integrated optical waveguide comprising:

a first optical waveguide with a first refractive index;

a third optical waveguide with the first refractive index; and

a second optical waveguiding region disposed between said first optical waveguide and said third optical waveguide, and having a second refractive index, wherein

said first optical waveguide is connected with said second optical waveguiding region such that an interface surface between said first optical waveguide and said second optical waveguiding

region is not perpendicular to the direction of said first optical waveguide;

said second optical waveguiding region is connected with said third optical waveguide such that an interface surface between said second optical waveguiding region and said third optical waveguide is not perpendicular to an extension line of a refraction direction through the interface surface between said first optical waveguide and said second optical waveguiding region; and

a refraction direction through the interface surface between said second optical waveguiding region and said third optical waveguide is in line with the direction of said third optical waveguide.

38. The integrated optical waveguide as claimed in claim 37, wherein a direction of said first optical waveguide is parallel to a direction of said third optical waveguide.

39. The integrated optical waveguide as claimed in claim 37, wherein a direction of said first optical waveguide is perpendicular to a direction of said third optical waveguide.

40. The integrated optical waveguide as claimed in any one of claims 37-39, wherein an angle of the interface surface between said first optical waveguide and said second optical waveguiding region with respect to the direction of said first optical waveguide is equal to an angle of the interface surface between said second optical waveguiding region and said third optical waveguide with respect to the direction of said third optical waveguide; and the angle θ of the interface surface between said

first optical waveguide and said second optical waveguiding region with respect to the direction of said first optical waveguide satisfies the following relationships,

$$4\theta_B/5 \leqq \theta \leqq \theta_B + 2/3(\theta_A - \theta_B)$$
$$\theta_B = \tan^{-1}(N_2/N_1)$$
$$\theta_A = \sin^{-1}(N_2/N_1)$$

where N_1 is the first refractive index and N_2 is the second refractive index.

41. The integrated optical waveguide as claimed in claim 40, wherein $\theta = \theta_B$.

42. The integrated optical waveguide as claimed in any one of claims 37-41, wherein said second optical waveguiding region has a waveguide structure.

43. The integrated optical waveguide as claimed in claim 42, wherein said second optical waveguiding region has an arc shape.

44. The integrated optical waveguide as claimed in any one of claims 37-43, wherein said first optical waveguide and said third optical waveguide are composed of semiconductors, and said second optical waveguiding region is composed of a material other than the semiconductors.

45. The integrated optical waveguide as claimed in any one of claims 37-44, wherein a refractive index ratio N_2/N_1 or N_1/N_2 is equal to or less than 0.9, where N_1 is the first refractive index

and N_2 is the second refractive index.

46. An integrated optical waveguide comprising a plurality of integrated optical waveguides as defined in any one of claims 37-45, which are connected in cascade.

47. The optical device as claimed in any one of claims 37-46, wherein at least one of said first optical waveguide and said third optical waveguide comprises:

a core layer formed on a semiconductor substrate;

an upper cladding layer stacked on said core layer, and having a conductivity type different from that of said semiconductor substrate;

a first electrode formed on said upper cladding layer; and

a second electrode formed on a back surface of said semiconductor substrate.

48. The optical device as claimed in any one of claims 37-47, wherein at least one of said first optical waveguide and said third optical waveguide has wavelength selectivity.

49. An optical device comprising an integrated optical waveguide as defined in any one of claims 37-48.